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A Study to Determine Relationships of Physical Fitness to Motor Educability, Scholastic Aptitude, and Scholastic Achievement of College Men.

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A STUDY TO DETERMINE RELATIONSHIPS OF PHYSICAL FITNESS TO MOTOR EDUCABILITY, SCHOLASTIC APTITUDE, AND SCHOLASTIC ACHIEVEMENT OF COLLEGE MEN

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by
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Dedicated to my wife, Minnie

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ABSTRACT

The purpose of this study was to determine the relationship of physical fitness to motor educability, scholastic aptitude, total grade point average for one semester and activity grades in physical education.

The subjects were 113 male students enrolled in tennis, golf and swimming in the basic skills program at Pensacola Junior College, Pensacola, Florida.

The Navy Standard Physical Fitness Test was administered to these students to determine level of physical fitness. This test includes push-ups, pull-ups, squat jumps, sit-ups and squat thrusts.

The Adams Motor Educability Test (sports-type) was used to measure motor educability. This test includes a volleyball wall volley, tennis ball toss, volleyball bounce on bat, and basketball free-throw shooting.

The School and College Ability Test which includes both quantitative and verbal batteries was used to measure scholastic aptitude. The total score for both batteries was used.

The total grade point average was computed by dividing total number of hours carried into total number of quality points. This information, for the fall semester of the 1963-64 school year, was made available by the Registrar at Pensacola Junior College.

The physical education grades for the tennis, golf and swimming classes were numerical grades based entirely on physical skills.

Statistical computations were calculated by the Louisiana State University Computer Center. The data were analyzed to determine relationships between physical fitness and each of the other variables. Then, coefficients of correlation were computed between physical fitness and motor educability for each physical education activity. In addition, intercorrelations were calculated between all of the variables in the study.

The findings were:

1. Significant correlation between physical fitness and motor educability.
2. Significant relationship between physical fitness and physical education activity grades.
3. Significant correlation when activity grades in physical education classes were regressed on physical fitness and motor educability.
4. No significant relationship between physical fitness and the School and College Ability Test (SCAT), nor with physical fitness and total grade point average.
5. When intercorrelations were computed between the variables of motor educability, SCAT scores, total grade point average and physical education activity grades, results

showed:

a. Motor educability was significantly related to physical education activity grades.

b. There was a significant correlation between SCAT scores and grade point averages for one semester.

c. Total grade point average had a relatively low but significant correlation with physical education activity grades.

6. Physical fitness and motor educability did not correlate as highly with grades achieved in golf as with tennis and swimming grades.

The author concluded that:

1. The degree of physical fitness a person possesses does not correlate with his performance on a scholastic aptitude test, nor is physical fitness directly related to scholastic achievement as measured by the student's grade point average for one semester.
2. Physical fitness is related to performance on a sports-type motor educability test.
3. Both physical fitness and motor educability are important in predicting achievement in physical education activity classes.
4. A scholastic aptitude test successfully predicts academic achievement as measured by total grade point average,

but is not effective in predicting success in physical activities.

5. Mental aptitude, as measured by the SCAT test, is not related to physical aptitude as measured by a sports-type motor educability test, therefore neither should be used as a single prognostic device to assess all the abilities needed for success in all college subjects.
6. Apparently, physical fitness and motor educability are more important for success in tennis and swimming, as measured by activity grades, than for success in golf.

CHAPTER I

INTRODUCTION

Physical educators have for years endorsed the belief that the level of physical fitness of a person will, to a certain extent, govern the amount and quality of his achievements. Such quotations as "the stronger the body, the more it obeys; the weaker the body, the more it commands," along with "a sound mind in a sound body" have been salient battle cries for the advocates of physical fitness.

In an effort to answer the question of how much physical fitness is needed, a respected textbook on physical education advocates that: "The person with adequate physical fitness should be able to carry out his daily tasks without undue fatigue and should still have an ample reserve of energy to enjoy leisure time and to meet unforeseen emergencies."[1] Although this is a reasonable statement, it nevertheless is based on the supposition that physical fitness is essential and even suggests that the degree of physical fitness is proportional to the well-being and productivity of the individual.

Physical education is one of the basic courses of study in the majority of college and university curricula. Its unique contribution

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[1] H. Harrison Clarke, Application of Measurement to Health and Physical Education (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1959), p. 16.

to general education lies in its concern for the development of physical qualities of students. Much work has been done in an endeavor to predict success in college by measures of academic preparation, scholastic aptitude, motivation and personality, but as yet the potentialities and limitations of these devices have not been satisfactorily determined. Those colleges and universities employing entrance and placement exams utilize measures designed to evaluate only mental ability or aptitude. Aside from the fact that nearly all educators contend that body and mind cannot be separated, more study is needed on relationships between physical and mental abilities.

With the current national emphasis on physical fitness, it seemed timely to investigate further the importance and ramifications of physical fitness as it relates to other abilities and achievements and its predictive ability for success in college work.

I. PURPOSE OF THE STUDY

This study attempted to yield further information on the relationships between certain physical and mental capabilities and achievements.

The role of physical fitness as it contributes to scholastic and physical achievements and as it is related to other abilities was investigated. An attempt was made to test the potentialities and limitations of a college entrance examination in predicting success in physical education activity classes as well as in other

college courses, as represented by total grade point average. The study investigated the relationship between a scholastic ability prognostic device and a physical ability prognostic device. The study was also concerned with the correlation between achievement of students in physical education activity courses and their other college subjects. Another facet of the study was to find which is the most important or most valid in predicting success in selected physical education activities, a test of physical fitness or a test of motor educability of the sports type.

More specifically, the purposes of this study were:

1. To determine the relationship of performance of male junior college freshmen on a test of physical fitness with: (a) motor educability of the sports type; (b) scholastic aptitude; (c) total grade point average for one semester; and (d) grades achieved in basic skills classes in tennis, golf, or swimming.
2. To further study the effects of the degree of physical fitness by comparing those freshmen students scoring high on a physical fitness test with those students scoring low on physical fitness on the variables of sports type motor educability, physical education grades, scholastic aptitude, and total grade point average.
3. To determine the inter-relationships of all the variables with one another.

II. DEFINITION OF TERMS

Physical Fitness

The term physical fitness was defined in this study as the level of development of the following components: (1) muscular strength and muscular endurance; (2) endurance (cardiovascular-respiratory); (3) muscular power; (4) flexibility; and (5) coordination and agility. The Navy Physical Fitness Test[2] was used to measure physical fitness in this study.

Motor Educability

There are two types of motor educability--stunt and sports type. Stunt type motor educability appears not to be highly related to sports type motor educability. This study utilized a test of the sports type motor educability and was defined as the ease and rapidity of learning a motor skill of the sports type. The Adams Motor Educability Test[3] was used in this study to measure motor educability of the sports type.

Scholastic Aptitude

Scholastic aptitude was defined as a measure of potential

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[2]Leonard A. Larson and Rachael D. Yocom, Measurement and Evaluation in Physical, Health and Recreation Education (St. Louis, Mo.: The C. V. Mosby Co., 1951), p. 177.

[3]Arthur R. Adams, "A Test Construction Study of Sport-Type Motor Educability for College Men" (unpublished Doctoral dissertation, Louisiana State University, Baton Rouge, Louisiana, 1954).

mental ability of a student to reach a level of scholastic achievement. The School and College Ability Test[4] was employed in this study as a measure of scholastic aptitude.

Basic Skills Classes

The term basic skills classes for this study referred to classes in the physical education service program at Pensacola Junior College. The three basic skills classes employed for this study were beginning tennis, swimming, and golf.

Grade Point Average

Grade point average was the total grade point average for the fall semester of the 1963-64 school year. This was found by dividing the total number of semester hours carried into the total number of quality points achieved.

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[4]School and College Ability Test, Cooperative Test Division, Educational Testing Service, 20 Nassau St., Princeton, New Jersey, and 4640 Hollywood Blvd., Los Angeles, California.

CHAPTER II

REVIEW OF RELATED LITERATURE

Research concerning relationships of the various complex ingredients that are combined to make up human behavior has produced conflicting results.

This section on related literature is divided into four main areas: (1) studies concerned with physical fitness and its relationship to scholastic aptitude and intelligence; (2) studies concerned with physical fitness and its relationship to scholastic achievement; (3) studies dealing with the relationship of physical fitness to motor educability and motor skill; and finally, (4) studies concerned with relationship of the qualities of scholastic achievement, scholastic aptitude, intelligence and motor educability that did not include physical fitness.

I. STUDIES CONCERNING PHYSICAL FITNESS AND ITS RELATIONSHIP TO SCHOLASTIC APTITUDE AND INTELLIGENCE

Weber[1] reported a .666 coefficient of correlation between physical fitness and composite scores on an entrance examination. He concluded that a physical fitness examination and a mental aptitude

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[1] Robert J. Weber, "Relationship of Physical Fitness to Success in College and to Personality" (unpublished Doctoral dissertation, State University of Iowa, 1950).

examination could be used as a scholastic ability indicator upon entrance to college. The physical fitness examination would increase the predictive value of mental tests considerably, according to the author.

Faine and Mathews[2] employed a modified Tuttle Step-up Test as a measure of physical fitness in a study of 125 junior high school children and found that the scores showed a high and significant coefficient of correlation with scores on the Otis Intermediate and Otis Higher Test as a measure of scholastic aptitude.

Hart,[3] using the Rogers Physical Fitness Index as a measure of fitness and the Cumulative Academic Index, including mathematical and verbal batteries, as a measure of scholastic aptitude, concluded that:

1. Students who have high physical fitness indices have high academic indices.
2. Although physical fitness is not a general predictor of academic success, it might be used if there is greater perfection of testing instruments.

McMillen[4] investigated the relationship of physical fitness to

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[2]Solomon Faine and Dennis T. Mathews, "Physical Fitness Test on New Zealand School Children," Research Quarterly, XXII (Dec., 1951), pp. 399-408.

[3]Marcia E. Hart, "A Study to Determine the Relationship Between Physical Fitness Indices and Academic Indices of Springfield College Sophomore Women" (unpublished Master's thesis, Springfield College, 1962).

[4]Betty Jo McMillen, "A Study to Determine the Relationship of Physical Fitness Test to the Academic Index of High School Girls" (unpublished Master's thesis, Springfield College, 1961).

the academic index of high school girls. The measures used to obtain the data were the New York State Physical Fitness Test and the Otis Quick-Scoring Mental Ability Test. She found a coefficient of correlation of .26 between physical fitness and scholastic aptitude.

Harris[5] divided 140 college women into high and low physical fitness groups. She measured various psychological traits by use of the Edwards Personal Preference Schedule. She found no significant difference between the two groups in these psychological traits.

Ilsley[6] computed various correlations to determine relationships among: (1) physical fitness, measured in terms of a modified Schneider Test figure; (2) weight; (3) height; (4) age; (5) blood pressure; (6) intelligence quotient; and (7) an illness factor. He found a coefficient of correlation of .045 between physical fitness and intelligence.

Jorgensen[7] used the Indiana Motor Fitness Indices No. 1 to determine the physical fitness rating and the American Council Psychological Examination (ACE) to measure potential scholastic

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[5]Dorothy Virginia Harris, "A Comparison of Physical Performance and Psychological Traits of College Women with High and Low Fitness Indices" (unpublished Master's thesis, Woman's College, University of North Carolina, 1957).

[6]Morrill L. Ilsley, "A Study of Correlations of Measurements of Men Stude[6]Morrill'omona College," Research Quarterly, XI (March, 1940), pp. 115-20.

[7]Robert R. Jorgensen, "The Relationship of Physical Fitness to Optimum Scholastic Achievement" (unpublished Master's thesis, University of Oregon, 1949).

achievement. He found a .074 coefficient of correlation between physical fitness and ACE scores.

Ricci[8] conducted a study to determine the relationship of physical fitness to scholastic aptitude and academic success of college freshman male students at the University of Massachusetts. The Rogers Physical Fitness Index was used to measure physical fitness. He found no significant relationship between physical fitness and scholastic aptitude.

Biddulph[9] divided high school boys into high and low physical fitness groups on the basis of strength, skill, endurance and power. He found no difference between the groups on intelligence quotient scores.

Summary

Of the above cited references, four of the authors found significant relationships between physical fitness and scholastic aptitude or intelligence. One author, Hart,[10] concluded that although physical fitness is not a general predictor of academic success, it could be used if there is a greater perfection of testing

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[8]Benjamin Ricci, "The Relationship of Physical Fitness, as Measured by the Roger's Fitness Index, to Academic Success of College Freshman Male Students" (unpublished Doctoral dissertation, Springfield College, 1958).

[9]L. G. Biddulph, "Athletic Achievement and the Personal and Social Adjustment of High School Boys," Research Quarterly, XXV (March, 1954), pp. 1-7.

[10]Hart, loc. cit.

instruments and techniques. The highest coefficient of correlation between physical fitness and scholastic aptitude was .666 reported by Weber.[11] Weber also concluded that a physical fitness test could increase the predictive value of mental accomplishments.

Five authors reported, as a result of their research, that little or no relationship exists between physical fitness and scholastic aptitude or intelligence. Harris[12] divided the groups into high and low fitness groups, as did Biddulph,[13] to conduct these studies. Ilsley[14] reported a coefficient of correlation as low as .045 between physical fitness and scholastic aptitude.

II. STUDIES RELATING PHYSICAL FITNESS TO SCHOLASTIC ACHIEVEMENT (Including Grades in Physical Education)

Weber[15] reported a .410 coefficient of correlation between physical fitness and grade point average for one semester and concluded that physical fitness, combined with a mental aptitude examination, could serve well as a predictor of academic success.

Faine and Mathews[16] studied 125 junior high school students and found a high and significant correlation between physical fitness and scholastic achievement as shown by grades for one school year.

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[11] Weber, loc. cit. [12] Harris, loc. cit.

[13] Biddulph, loc. cit. [14] Ilsley, loc. cit.

[15] Weber, loc. cit. [16] Faine and Mathews, loc. cit.

Hart[17] used the Rogers Physical Fitness Index to determine a level of physical fitness and concluded that physical fitness is an important factor for the improvement of academic success in the general education of a college student.

Werner[18] conducted studies at the United States Military Academy which indicated that there were significant, positive relationships between physical fitness as measured by the Army Physical Fitness Test and other criteria. The findings showed:

1. Fifty-one per cent of the cadets who leave the Military Academy, for all or any causes, are in the bottom seven per cent in tests of physical fitness.
2. Of those discharged due to academic failure, 16.5 per cent were in the bottom seven per cent, physically.

In a study at Springfield College, Gunkler[19] found a coefficient of correlation of .419 between physical fitness, as measured by the Rogers Physical Fitness Index, and physical education activity grades.

McMillen[20] correlated physical fitness, as measured by the New

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[17]Hart, loc. cit.

[18]Alfred Werner, "Physical Education and the Development of Leadership Characteristics of Cadets at the United States Military Academy" (unpublished Doctoral dissertation, Springfield College, 1960).

[19]O. H. Gunkler, "Body Mechanics and Physical Fitness as Related to Intelligence, Scholarship and Physical Education Grades" (unpublished Master's thesis, Springfield College, 1933).

[20]McMillen, loc. cit.

York State Physical Fitness Test, with academic grades for the school year, for a group of high school girls and found a coefficient of correlation of .36 between the two variables.

Biddulph[21] divided a group of high school boys into high and low physical fitness groups and found that the high physical fitness group had a significantly higher grade point average than did the low fitness group.

Ilsley[22] reported a correlation of .049 between physical fitness and scholastic achievement for one semester in his study of new students at Pomona College.

Jorgensen[23] correlated physical fitness, as measured by the Indiana Motor Fitness Indices No. 1, with grade point average for one school year and reported a coefficient of correlation of .135.

Ricci[24] studied male freshman students at the University of Massachusetts to determine the relationship of physical fitness to the academic success of these students. He found no significant relationship between physical fitness and quality point average.

Summary

Seven authors in the group of above cited references found significant relationships between physical fitness and scholastic achievement. One author, Gunkler,[25] reported a significant

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[21]Biddulph, loc. cit. [22]Ilsley, loc. cit.

[23]Jorgensen, loc. cit. [24]Ricci, loc. cit.

[25]Gunkler, loc. cit.

relationship between physical fitness and physical education activity grades.

Only three authors found no significant relationship between physical fitness and academic achievement.

III. STUDIES CONCERNING PHYSICAL FITNESS AND ITS RELATIONSHIP TO MOTOR EDUCABILITY AND MOTOR SKILLS

Harris[26] studied 140 college women and divided them into high and low physical fitness groups. She found the high physical fitness group to be superior in gross motor performance as measured by the Scott Motor Ability Battery. She also found that the high physical fitness group was superior on each individual item on the test battery as well.

Ilsley[27] conducted a study at Pomona College in which he correlated physical fitness, as measured by a modification of the Schneider Test, with agility scores measured by a motor educability test constructed by the Athletic Department at Pomona College. He reported a low correlation of .108 between physical fitness and motor educability.

Summary

The writer was able to find only two studies concerned with the

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[26]Harris, loc. cit. [27]Ilsley, loc. cit.

relationship of physical fitness to motor educability or motor performance. There were conflicting findings reported by the two authors.

IV. STUDIES CONCERNING RELATIONSHIPS BETWEEN MOTOR EDUCABILITY AND SKILL, SCHOLASTIC APTITUDE AND SCHOLASTIC ACHIEVEMENT

Ismail, Kephart and Cowell[28] employed various motor items to represent motor aptitude, and the Stanford Standard Achievement Test as an estimate of academic achievement. They concluded:

1. In low achievers on motor aptitude, I. Q. scores can be predicted from motor aptitude test batteries more accurately than in either higher or medium achievers.
2. The high achievers were superior to both the medium and low achievers in terms of coordination and static balance items.
3. There was no difference between high and medium groups in performance on speed, accuracy, strength and velocity.

Vickers, Poyntz and Baum[29] correlated scores on the revised

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[28]A. H. Ismail, N. Kephart and C. C. Cowell, "Utilization of Motor Aptitude Tests in Predicting Academic Achievement," Indiana State Board of Health, Technical Report No. 1, August, 1963.

[29]Vernette Vickers, Lillian Poyntz and Mable Pottinger Baum, "The Brace Scale Used with Young Children," Research Quarterly, XIII (October, 1942), pp. 299-308.

Stanford-Binet Scale with scores on the Brace Scale and found that a high score of motor ability was associated with high intelligence. This study was done with children in the age group of five to nine years. When the groups were sub-divided into high and low in motor ability, the authors found that there was a significant relationship between high intelligence and good motor ability and inversely, a low rating in both intelligence and motor ability.

Brace[30] found no correlation between the ability of high school girls to learn a number of motor skills and I. Q. However, using mental defectives, he found correlations ranging from .15 to .51 between I. Q. and the ability to learn selected motor skills.

Start[31] gave thirty-five boys nine five-minute periods of mental practice at the underarm free throw. The mental practice consisted of simply mentally practicing the free throw, without moving and without a spoken description. The subjects were tested for accuracy of free throw shooting before and after the mental practices. He measured intelligence by use of a mental aptitude test. It was found that the significant gains obtained could not be related to the initial scores, or to the intelligence of the throwers.

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[30] D. K. Brace, "Studies in the Rate of Learning Gross Bodily Skills," Research Quarterly, XII (May, 1941), pp. 181-85.

[31] K. B. Start, "Relationship Between Intelligence and the Effect of Mental Practice on the Performance of a Motor Skill," Research Quarterly, XXXI (December, 1960), pp. 644-49.

Shelly[32] gave various tests in football, basketball, track, baseball and wrestling in order to measure motor skill and educability, utilizing the Otis Quick Scoring Mental Ability Test as an intelligence measure. He concluded that the subjects who were outstanding in as many as four sports were more mature, had larger bodies, greater motor ability scores, were much stronger and had higher intelligence than were the subjects who performed well in only one, two or three sports.

Henry and Nelson[33] found that speed of performance of a sensory-motor skill was slower in boys ten years old than in boys fifteen years old in both initial performance and in final performance after learning had reached a plateau. The younger boys improved more and had less task-specificity than the fifteen year old boys, and their individual differences in learning had a greater influence in determining final skill than for the older boys. Fifty per cent of individual differences in motor learning were predictable from the pre-learning performance, and the direction of the relationship was negative, showing the futility of attempting to measure educability from performance level. It was concluded that learning ability must be tested directly.

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[32]Morgan E. Shelly, "Maturity, Structure, Strength, Motor Ability and Intelligence Test Profiles of Outstanding Elementary School and Junior High School Athletics" (unpublished Master's thesis, University of Oregon, June, 1960).

[33]F. M. Henry and G. A. Nelson, "Age Differences and Inter-relationships between Skill and Learning in Gross Motor Performances of Ten and Fifteen-Year Old Boys," Research Quarterly, XXVII (May, 1956), pp. 162-75.

DiGiovanna[34] investigated the relationship between intelligence and athletic achievement. He used the Otis Self-Administering Tests of Mental Ability Higher Examination (Form B) to determine intelligence, the Brace Motor Ability Tests, and scaled tests in physical education as measures of athletic ability. He concluded that there is a definite correlation between intelligence and athletic ability and intelligence and motor ability in college men.

Ryan[35] tested eighty male college students on the stabilometer to examine the relationship between performance in academic achievement and academic capacity and selected motor skills. He used a college entrance examination to measure academic capacity. Grade point averages and college entrance examination scores were converted to Z-scores and each subject was designated as an over-achiever if his grade point Z-score was higher than his college entrance Z-score. It was found that performance of the over-achievers was significantly better in motor skills than the under-achievers.

Ray,[36] in an experiment with athletes, found:

1. Top athletes are not low in mental ability, though individuals of very high I. Q. frequently forego athletics.

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[34]Vincent G. DiGiovanna, "A Comparison of the Intelligence and Athletic Ability of College Men," Research Quarterly, VIII (October, 1937), pp. 96-106.

[35]E. Dean Ryan, "Relative Academic Achievement and Tabilometer Performance," Research Quarterly, XXXIV (May, 1963), pp. 185-90.

[36]Howard C. Ray, "Interrelationship of Physical and Mental Abilities and Achievements of High School Boys," Research Quarterly, XI (March, 1940), pp. 129-41.

2. Physical ability seems to be a more reliable predictor of academic standing than is I. Q.
3. The good athlete is not only superior in mental ability as measured by I. Q., but more superior as measured by number of academic failures.

Brown and Henderson[37] studied the relationship between certain intellectual, physical growth, physical performance and social-emotional variables in order to develop an index for predicting academic achievement of fourth grade pupils. Utilizing the factor analysis technique they concluded that it is possible to identify specific developmental factors and that four factors—an intellectual factor, physical growth, physical performance, and an emotional factor—were identified.

Johnson[38] found a coefficient of correlation between the Johnson Skill Test of Athletic Ability and an intelligence test of -.058. He further concluded, from his study, that:

1. There was no significant relationship between motor skill and mental power or general intelligence.
2. There was no sex difference in either physical skill or general intelligence.

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[37]R. Brown and E. Henderson, et al., "Measuring Physical, Intellectual, and Social-emotional Development" (unpublished paper, presented at AERA, Februacy, 1962).

[38]G. B. Johnson, "A Study of the Relationship that Exists Between Physical Skills as Measured, and the General Intelligence of College Students," Research Quarterly, XIII (March, 1942), pp. 57-59.

3. There was but a hint of relationship between motor skill and grades achieved in physical education classes.

4. There was no relationship between motor skill and academic grades.

Asmussen and others[39] studied the causal effects of sex, age and intelligence on certain motor skills. The subjects were Danish boys and girls, ranging from seven to seventeen years of age. I. Q. data were obtained from use of the Binet Test. They concluded that sex differences in motor performance were most pronounced in the youngest children. Age seemed to have a positive influence on motor skills, mostly in tests that require a high degree of neuromuscular coordination. The age of puberty seems to increase physical capacities as related to body height in boys and tends to decelerate the development of motor performance in girls. Intelligence seemed to play no statistically significant role.

Berk[40] compared subnormal, normal and gifted children on the Oseretsky Test of Motor Ability and found a low, but positive, correlation between intelligence and motor performance. There was no difference between the normal and gifted children in motor performance, however, the subnormal group was much lower than both of the other groups.

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[39]Erling Asmussen and Nielsen Heiball, "Physical Performance and Growth in Children--Influence of Sex, Age and Intelligence," Journal of Applied Physiology, 8, 1956.

[40]Robert Berk, "Comparison of Performance of Subnormal, Normal and Gifted Children on the Oseretsky Tests of Motor Ability" (unpublished Doctoral dissertation, Boston University, Boston, Mass., 1957).

Summary

Conflicting results were reported in the literature cited above. Five studies[41,42,43,44,45] found significant relationship between motor ability and intelligence whereas three studies[46,47,48] reported no relationship. Two other studies[49,50] found a relationship of motor performance and intelligence only for persons of subnormal intelligence. Three of the studies[51,52,53] reviewed in the above section, found a significant relationship between motor performance and academic achievement. One study[54] found a very slight correlation between motor skill and grades in physical education but no relationship between motor skill and academic grades.

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[41] Ismail and others, loc. cit.

[42] Vickers and others, loc. cit.

[43] Shelly, loc. cit. [44] DiGiovanna, loc. cit.

[45] Ray, loc. cit. [46] Start, loc. cit.

[47] Johnson, loc. cit. [48] Asmussen and others, loc. cit.

[49] Brace, loc. cit. [50] Berk, loc. cit.

[51] Ryan, loc. cit. [52] Ray, loc. cit.

[53] Brown and Henderson, loc. cit.

[54] Johnson, loc. cit.

CHAPTER III

DESCRIPTION OF PROCEDURE

Data were gathered on 113 male junior college students. The Navy Physical Fitness Test[1] was used for a fitness measure; the Adams Motor Educability Test[2] was used as the motor educability measure; and the School and College Ability Test[3] was used to measure scholastic aptitude. A standardized procedure for grading was established in order to assure that the subjects in this study were graded on physical skill performance only in the activity classes chosen. All testing was done under the supervision of the writer with assistance from faculty members employed in the Physical Education Department. The total grade point average at the end of the fall semester of the school year 1963-64, showing academic achievement, was made available to the examiner by the Registrar at Pensacola Junior College.

In analyzing the data which were collected, statistical computations were calculated. Various correlations were computed, showing combinations of relationships as well as individual relationships among the variables studied. Another aspect of the study included dividing the subjects into high and low fitness groups and

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[1]Larson and Yocom, loc. cit.

[2]Adams, loc. cit.

[3]School and College Ability Test, loc. cit.

comparing the means of these groups in all factors tested, in order to determine whether or not significant differences existed between the high and low fitness groups in these factors.

I. SELECTION OF SUBJECTS

The subjects participating in this study were 113 male freshmen at Pensacola Junior College, Pensacola, Florida. It was felt that the subjects comprised a random sample of male college freshmen at this institution. All freshmen are required to take basic skills courses in physical education and the students select an activity of their choice.

The investigator selected subjects from three of the activities offered. Two classes each in tennis, golf and swimming were selected. The number of students in each activity was: twenty-eight in tennis, forty in golf, and forty-five in swimming.

II. DATA USED IN STUDY

The following data were collected for all subjects:

1. A physical fitness test score (as measured by the Navy Standard Physical Fitness Test).
2. A sports type motor educability test score (as measured by the Adams Motor Educability Test).
3. A scholastic aptitude test score (as measured by the School College and Ability Test).
4. A numerical physical education activity grade (using

standardized procedures of grading for the class in which subject was enrolled.

5. The total grade point average for the fall semester of the school year 1963-64. This was computed by dividing the number of quality points achieved into the number of hours carried by each student.

III. COLLECTION OF THE DATA

Navy Standard Physical Fitness Test

The Navy Standard Physical Fitness Test[4] was the first physical fitness test of the armed services to be devised and has been used in research projects as a measure of physical fitness. It consists of five items—squat jumps, sit-ups, push-ups, squat thrusts for one minute, and pull-ups. A detailed description of each item is given in Appendix A.

Since the Navy Standard Physical Fitness Test is a five item test, the investigator set up five testing stations with one faculty member assigned to each station. Each member of the testing faculty was well prepared to administer the test item assigned as a result of reading the guide provided and the practice which preceded the actual testing. The rules for administering the tests were followed rigidly in order to assure accurate results. The testing was done by classes, for the most part. Each class utilized one of its regular class

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[4]Larson and Yocom, loc. cit.

meetings for the purpose of testing physical fitness for this investigation. The swimming classes were tested first, with the golf and tennis classes following in that order.

As with most physical fitness tests, it seemed advisable that the subjects be familiar with the test items before the actual testing. In order to acquire this familiarity with the items, each class was briefed on each item and allowed to go through each exercise for a short time one week prior to the actual testing period. The investigator pointed out to each individual any flaws or errors in the procedure. It was felt that this aided considerably in assuring a more accurate set of data for this particular test.

The Navy instructions for this test recommend that a five minute rest period be taken between test events, as well as brief warm-up calisthenics prior to the testing program. Both of these suggestions were followed with each class in each of the testing periods.

T-scores have been constructed from data based upon a number of conditioned Naval personnel. However, it was suggested that it is advisable, in making application of this test to school groups, to construct the T-tables from data gathered upon youngsters to whom the norms are to be applied. Once the scales are computed a common fitness index may be obtained by dividing the sum of the scores of the five events by five. It was decided that for the purpose of this study the raw scores would be more appropriate as being representative of physical fitness for each subject.

Adams Motor Educability Test (Sport-type)

The Adams Motor Educability Test[5] was chosen primarily because it was the only recognized measure of sports-type motor educability found in the literature. Actually, there are two types of motor educability tests—the stunt type and the sports-type. Stunt type motor educability has not been found to be highly related to sports-type motor educability.

Adams conducted a study in which he selected a battery of tests from an experimental group of forty-nine tests that would maximally predict sports-type motor educability for male college freshmen. A detailed description of the Adams Test may be seen in Appendix B.

Several meetings were held by the investigator with five other Pensacola Junior College faculty members employed in the Physical Education Department. A test manual was developed to be used as a guide during the administration of the motor educability test. The same procedure was used as in the physical fitness testing.

School and College Ability Test

The School and College Ability Test[6] (hereafter referred to as the SCAT Test, as it is commonly called) is given to every

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[5]Adams, loc. cit.

[6]School and College Ability Test, loc. cit.

freshman student at the Pensacola Junior College. The School and College Ability Test is designed to measure the ability to perform in a classroom situation. The scores--verbal, quantitative, and total--are reported in percentiles based on national norms for college freshmen. The minimum score for admission to Pensacola Junior College is the fifteenth percentile for the total score.

The testing of the subjects in this investigation was conducted during the summer of 1963, prior to the student entering college, under the direction of the Dean of Student Personnel at Pensacola Junior College, Pensacola, Florida. The Dean of Student Personnel made the necessary data for this study available to the investigator during the fall semester of the school year 1963-64. A complete description of this test may be seen in Appendix C.

Grades in Physical Education Classes

Three meetings were held by the investigator prior to the time that the collection of data began in order to establish a standardized procedure of grading since the investigator would not be issuing grades to all subjects in the study. Two fellow faculty members attended these meetings--the swimming instructor and the golf instructor. The investigator was the tennis instructor.

For the purposes of this study, the grades awarded to subjects used in this study were to be totally skill grades, represented numerically. Every effort was made to assure that all subjects enrolled in each activity would receive the same instruction from the same instructor and would be graded on the same skill tests.

Each of the classes in this study met in a two hour block of time, once every week for eighteen weeks. There were eighteen class meetings, with thirty-six total hours of instruction given. Each class was taken by the student for one semester hour of credit.

In grading the students, the Pensacola Junior College grading system was used, with an A being from 90 to 100, B from 80 to 89, C from 70 to 79, D from 60 to 69, and below 60 an F. A grade of 60 or better is a passing grade.

Skill Tests Used to Evaluate Student Performance in Tennis, Golf and Swimming

Tennis. In teaching the three basic strokes, the instructor taught the forehand, backhand and service strokes in that sequence. In teaching the basic strokes primary emphasis was placed on grip, footwork, court position and stroking, with little concern for strategy. As soon as basic stroke skills were adequate, competitive matches were arranged using a ladder-type tournament for this competition. This was done during the last five class meetings with the instructor giving constructive criticism to each individual.

The Dyer backboard test of tennis ability was utilized in measuring forehand and backhand skills in tennis. This test simply measures the ability to volley a tennis ball against a backboard, attempting to score as many hits as possible in thirty seconds. There have been several revisions of this test with the validity of the test being improved by moving the subject five feet from the volley wall. The revised method by Dyer in 1938 was used in testing the subjects in this study as one measure of tennis ability.

The backboard design used in the backboard service test was the same as that used for the Louisiana State University Test (Robinson Backboard Test). Numbers from one to five are drawn on the backboard. The server stands approximately forty-two feet away from the wall and serves ten balls from the right service court and ten balls from the left service court, with the total score on the test being the combined point total of the twenty trials.

Near the end of the semester, this investigator (who has worked as a tennis professional) rallied with each of the subjects alternating hits to the backhand and forehand. A subjective rating with a scoring scale from one to ten was utilized in arriving at a numerical score.

Competitive ratings were used in order to further evaluate the student's skills in a competitive situation. A challenge ladder-type tournament was organized for each class in order to evaluate students in competition.

Swimming. The skills recommended by the American National Red Cross for beginning swimmers were taught and tested in order to arrive at a numerical grade in this activity.

To measure the progress and test the capabilities of the learning swimmer, a series of standards of achievement were given. Individual beginner skills were listed separately on the test sheet and were checked off during the course as they were mastered. Mastery does not mean the mere doing of the skill, but implies practiced and fairly smooth accomplishment. The instructor conducted the class by

offering instruction in the prescribed skills and taught them in the sequence listed below. The instructor tested pupils on groups of skills according to the listed phases of learning at the conclusion of the instruction and practice in each phase of learning. Only the major achievements are listed as items in the test. In Appendix D a detailed description of all the items is given. The items were:

1. Breath Holding
2. Rhythmic Breathing
3. Prone Float
4. Prone Glide
5. Back Float
6. Back Glide
7. Kick Glide on the Front
8. Kick Glide on the Back
9. Arm Stroke
10. Arm Stroke on Back
11. Combined Stroke on the Front
12. Combined Stroke on the Back
13. Change of Direction
14. Turning Over
15. Leveling Off
16. Feet Foremost Jump into Waist-deep Water
17. Jump into Deep Water, Level and Swim
18. Plain Front Header

19. Jump and Turn-about

20. Dive and Turn-about

Golf. Golf scores made on a regulation golf course were recorded after instruction had been given in each of the basic clubs, which included the number 2 wood, the number 3, 5 and 7 irons and the putter. Considerable practice was allowed with each of the clubs under the careful supervision of the golf instructor. On the campus at Pensacola Junior College there are two pitching greens and two separate putting greens. Also, adjoining the Junior College property is a large field where skill tests measuring form and accuracy were given twice on pitching, putting and driving from various distances. These scores, plus the scores recorded on the golf course, were converted to a numerical grade and averaged to represent the final grade for this course.

Grade Point Average

It was determined that an additional aspect of this investigation would include the relationship of a total grade point average for the fall semester of the school year 1963-64 to other factors measured in this study. This average was computed by dividing the number of quality points achieved by the number of hours carried by each student, and the necessary data for this computation were made available to the investigator by the Registrar of the Pensacola Junior College. Grading at Pensacola Junior College is done on a four point system with a grade of A being assigned 4 points, B three points, C two points, and D one point.

IV. STATISTICAL TREATMENT OF DATA

The Louisiana State University Computer Research Center was used to compute the data gathered for this study. The raw scores were entered on I.B.M. score sheets which were used to provide information for the punching of I.B.M. cards. These cards were then used to compute the final results or findings for this study.

Zero-order correlations, multiple regressions and comparison of means were used to analyze the data.

CHAPTER IV

PRESENTATION OF DATA

In analyzing the data, coefficients of correlation were obtained between physical fitness and motor educability, SCAT scores, total grade point average for one semester, and a numerical physical education activity grade for one semester for the total group of subjects. In addition, regression coefficients were calculated to determine how dependent the other variables were on physical fitness. A t-ratio and a probability ratio were determined for each of these correlations to indicate significance of the relationship. Variation percentages were also calculated for more meaningful interpretations. Intercorrelations were computed between all variables studied. An additional aspect of the study involved dividing the group into high and low physical fitness groups. This was done by taking the upper 25 per cent of the total group on the physical fitness test to represent the high group, and the lowest 25 per cent to represent the low fitness group. The means, standard deviations, standard errors of the means and standard error of the difference between the high and low fitness groups were calculated and t-tests computed to see if subjects of high fitness differed significantly from low fitness subjects on the different variables studied.

After these calculations were completed for the total group,

relationships of physical fitness and motor educability to activity grades achieved were calculated for the individual activity groups which included tennis, golf and swimming.

I. TOTAL GROUP ANALYSIS

Using the total group data, coefficients of correlation were computed between the score on physical fitness with motor educability, SCAT scores, total grade point average and physical education activity grades. When significant correlations existed, regression equations and variation percentages were figured. This treatment of the data is shown in Table I.

TABLE I

COEFFICIENTS OF CORRELATION OF MOTOR EDUCABILITY, SCAT SCORES, GRADE POINT AVERAGE AND ACTIVITY GRADES WITH PHYSICAL FITNESS SCORES OF 113 JUNIOR COLLEGE MEN

Physical Fitness Scores With:	Coefficient of Correlation	Regression Coefficient	Variation Percentages	T-Ratio	P
Motor Educability	.388	.143	.15	3.62	.01
SCAT Scores	-.032	.021	.001	.32	—
Total Grade Point Average	.170	.004	.028	1.84	—
Physical Education Activity Grades	.508	.153	.25	4.52	.01

Relationship of Physical Fitness to Motor Educability

The coefficient of correlation between physical fitness and motor educability was .388. This correlation was significant at the .01 level of confidence as shown by a t of 3.62. The interpretations of the computed regression coefficient of .143 would be that an increase or decrease of one point in physical fitness would be accompanied by an increase or decrease of .143 in motor educability. The calculation of variation percentages further illustrates the relationship of these two variables revealing that 15 per cent of the variation in motor educability scores can be accounted for by variation in physical fitness.

Relationship of Physical Fitness to SCAT Scores

As shown in Table I, a coefficient of correlation of -.032 was calculated between physical fitness and SCAT scores, indicating no relationship. Consequently, the t of .32 revealed no significance.

Relationship of Physical Fitness to Total Grade Point Average for One Semester

The coefficient of correlation between physical fitness and total grade point average was .170 showing a very negligible relationship. The t of 1.84 failed to be significant at the .05 level of probability.

Relationship of Physical Fitness to Grades Received in a Physical Education Activity Class

The coefficient of correlation between physical fitness and physical education activity grades was .508. The t of 4.52 was significant at the .01 level of probability as shown in Table I. Further, calculations revealed a regression coefficient of .153 indicating that an increase or decrease of one point in physical fitness would cause a corresponding increase or decrease of .153 in physical education grades. It was also found that 25 per cent of the variation in activity grades received can be accounted for by variations in physical fitness.

II. COMPARISON OF HIGH AND LOW PHYSICAL FITNESS GROUPS

In order to test the hypothesis that persons of high physical fitness may achieve more than persons scoring low in physical fitness, the upper quartile and lower quartile of physical fitness scores were selected for further study and analysis. It was felt that in the total group analysis there may not have been a wide enough range in scores to show whether the degree of physical fitness was related to achievement in the other variables studied.

Therefore, the mean scores of the high and low physical fitness groups were compared for each of the other variables of motor educability, SCAT scores, grade point average and activity grades.

As a check to see whether or not eliminating the middle 50 per cent of scores had differentiated the high and low fitness groups,

a t test was computed. It was found that the high group had a mean of 175 on the Navy Standard Physical Fitness Test, as compared to 105 for the low fitness group. The calculated t of 20.06 showed that the observed difference of 70 points was significant beyond the .01 level of confidence. According to Garrett,[1] a t of 2.01 was needed to be significant at the .05 level of confidence and 2.67 for the .01 level of confidence. It should be mentioned that even though the division of the groups into high and low fitness groups did establish a wider range of fitness, results of the subsequent comparisons might have been more significant if a wider range could have been established with a larger group of subjects. The data for these computations are shown in Table II.

TABLE II

A COMPARISON OF MEANS OF TWENTY-EIGHT HIGH AND TWENTY-EIGHT LOW PHYSICAL FITNESS SUBJECTS IN MOTOR EDUCABILITY, SCAT SCORES, GRADE POINT AVERAGE AND ACTIVITY GRADES

Variables	Mean High Group	Mean Low Group	Standard Error of the Difference Between Means	t	P
Physical Fitness	175	105	3.49	20.06	.01
Motor Educability	53	45	2.07	3.86	.01
SCAT	54	57	3.89	.77	--
Grade Point Average	1.78	1.58	.15	1.33	--
Activity Grades	80	73	1.62	4.32	.01

[1]Henry E. Garrett, Statistics in Psychology and Education, (fifth edition; New York: Longmans, Green and Company, 1958), p. 191.

Comparison of High and Low Physical Fitness Groups in Motor Educability

From Table II, it may be seen that the high fitness group had a mean of 53 in the Adams Motor Educability Test (sports-type), whereas the low fitness group mean was 45. This yielded a t of 3.86 which was significant at the .01 level of confidence. This finding confirmed the coefficient of correlation analysis of the total group which indicated a positive relationship of motor educability with physical fitness.

Comparison of High and Low Physical Fitness Groups in SCAT Scores

The high fitness group had a slightly lower mean score on the School and College Ability Test than the low fitness group. The high group had a mean of 54 as compared to 57 for the low fitness group. However, this observed difference was not significant as shown in Table II by a t of .77.

Comparison of High and Low Physical Fitness Groups in Total Grade Point Average for one Semester

The mean grade point average for one semester for the high physical fitness group was 1.78. The low physical fitness group's mean was 1.58. The comparison of means yielded a t of 1.33 which did not reach the .05 level of confidence indicating that those high in physical fitness did not achieve more than those students having the same scholastic potential (as measured by the SCAT test) but possessing significantly poorer physical fitness.

Comparison of High and Low Physical Fitness Groups in Physical Education Activity Grades

In Table II, page 36, the mean numerical physical education activity grade is shown to be 80 for the high physical fitness group with the low fitness group scoring an average grade of 73. A comparison of means revealed this difference to be significant at the .01 level of confidence. This confirms the analysis by correlation for the total group, indicating the importance of physical fitness for success in physical education activity classes.

III. ANALYSIS OF DATA BY ACTIVITY GROUPS

It was felt that it would be worthwhile to view the relationship of physical fitness and motor educability to success in the different physical education activities of tennis, golf and swimming. The purpose of the analysis was to determine whether achievement, as measured by skill grades in the different sports was affected or could be predicted more adequately for motor skills of the sports-type. For example, it might be hypothesized that physical fitness would be more important for success in a swimming class than motor educability, whereas success in a less strenuous activity such as golf might better be predicted by a motor educability test of the sports-type. The results of this analysis are presented in Table III.

Group 1--Tennis

The coefficient of correlation between physical fitness and grades achieved in a tennis class was .655. A t yield of 5.82 was

TABLE III

COEFFICIENTS OF CORRELATION OF PHYSICAL FITNESS AND MOTOR EDUCABILITY WITH GRADES ACHIEVED IN TENNIS, GOLF, AND SWIMMING CLASSES FOR 113 MALE JUNIOR COLLEGE FRESHMEN

Group 1—Tennis

Tennis Grades With:	Coefficient of Correlation	Regression Coefficient	Variation Percentage	T-Ratio	P
Physical Fitness	.655	.17	.42	5.82	.01
Motor Educability	.572	.39	.32	4.68	.01

Group 2—Golf

Golf Grades With:	Coefficient of Correlation	Regression Coefficient	Variation Percentage	T-Ratio	P
Physical Fitness	.276	.099	.097	1.99	.05
Motor Educability	.107	.126	.091	.552	—

Group 3—Swimming

Swimming Grades With:	Coefficient of Correlation	Regression Coefficient	Variation Percentage	T-Ratio	P
Physical Fitness	.526	.29	.27	3.91	.01
Motor Educability	.364	.18	.13	2.47	.01

found to be significant at the .01 level of confidence. Further computation revealed that 42 per cent of the variation in tennis activity grades could be accounted for by variation in physical fitness.

The coefficient of correlation between motor educability of the sports-type and tennis grades was .572. The t of 4.68 was found to be significant at the .01 level of confidence. It was also found that 32 per cent of the variation in grades achieved in the tennis class could be accounted for by variation in motor educability as shown in Table III, page 39. These correlations indicate the importance of physical fitness and motor educability in achieving grades in tennis.

Group 2--Golf

A coefficient of correlation of .276 was computed between physical fitness and grades achieved in golf classes. A t of 1.99 was found to be significant at the .05 level of confidence. A variation percentage of .097 per cent was calculated indicating the relative unimportance of physical fitness in achieving good golf grades.

The coefficient of correlation between motor educability and grades achieved in golf classes was .107. A t test was computed and the t of .552 was not significant. A variation percentage of only .091 was found, indicating that variations in motor educability caused a negligible change in grades achieved in golf classes.

Thus it can be seen that apparently success in golf as measured

by activity grades is not as dependent upon physical fitness and motor educability as are tennis and swimming.

Group 3--Swimming

The coefficient of correlation between physical fitness and grades achieved in swimming classes was .526. The t test yield of 3.91 was significant at the .01 level of confidence. It was found that 27 per cent of the variations in grades achieved in swimming classes could be accounted for by variations in physical fitness. This possibly indicates the importance of physical fitness in achieving grades in swimming classes.

The correlation between motor educability and grades achieved in swimming classes was .364. Although not as high as the correlation between physical fitness and grades achieved, the relationship was still significant at the .01 level of confidence. Further calculations revealed that 13 per cent of the variations in grades achieved could be accounted for by variations in motor educability.

IV. MULTIPLE REGRESSION OF PHYSICAL FITNESS AND MOTOR EDUCABILITY WITH OTHER VARIABLES

Using physical fitness and motor educability (sports-type) as independent variables, multiple regression equations were calculated for School and College Ability Test scores, total grade point average for one semester and physical education activity grades. This analysis is presented in Tables IV, V, and VI.

TABLE IV

MULTIPLE REGRESSION DATA OF TOTAL GRADE POINT AVERAGE ON PHYSICAL FITNESS AND MOTOR EDUCABILITY FOR 113 MALE JUNIOR COLLEGE FRESHMEN

Multiple Variables	Partial Regression Coefficient	T	P	R^2	Multiple R
Physical Fitness	.005	1.25	-	.042	.205
Motor Educability	-.009	-1.40	-		

TABLE V

MULTIPLE REGRESSION DATA OF SCAT SCORES ON PHYSICAL FITNESS AND MOTOR EDUCABILITY FOR 113 MALE JUNIOR COLLEGE FRESHMEN

Multiple Variables	Partial Regression Coefficient	T	P	R^2	Multiple R
Physical Fitness	-.033	-.423	-	.022	.148
Motor Educability	.065	.326	-		

TABLE VI

MULTIPLE REGRESSION DATA OF ACTIVITY GRADE ON PHYSICAL FITNESS AND MOTOR EDUCABILITY FOR 113 MALE JUNIOR COLLEGE FRESHMEN

Multiple Variables	Partial Regression Coefficient	T	P	R^2	Multiple R
Physical Fitness	.128	4.99	.01	.302	.548
Motor Educability	.172	2.55	.01		

It was found that no significant relationship existed between physical fitness scores combined with motor educability scores when the SCAT scores and total grade point average were regressed, as seen in Tables IV and V, page 42.

However, in Table VI, page 42, a very significant relationship was found when activity grades of the total group were regressed on multiple variables of physical fitness and motor educability. A multiple regression of .548 was found with a partial regression of .128 for physical fitness and a .172 for motor educability. The partial regression coefficients indicate the beta weight of the variable held constant on the variable being regressed.

V. INTERCORRELATION OF ALL VARIABLES

In order to investigate all facets of the data available and answer certain questions concerning the interrelationships of the measures, coefficients of correlation were computed between each variable and every other one. This was done to answer such questions as: (1) How well does SCAT predict total grade point average?; (2) How well does SCAT predict physical education grades?; (3) How does a supposedly physical aptitude test (Adams Motor Educability Test) relate to a primarily mental aptitude test (SCAT)?; (4) How does a person's grade in physical education relate to or indicate his grades in other subjects, as shown by grade point average?. The intercorrelations are presented in Table VII. Since total group correlations between physical fitness and the other variables studied have

been discussed previously, this section will deal with the other intercorrelations remaining, including motor educability, SCAT scores, total grade point average for one semester and an activity grade in a physical education class.

TABLE VII

INTERCORRELATIONS OF ALL VARIABLES FOR 113 JUNIOR COLLEGE MALE STUDENTS

	Physical Fitness	Motor Educability	SCAT Scores	Total Grade Point Average	Physical Education Grade
Physical Fitness	—	.388	-.321	.170	.508
Motor Educability	.388	—	.091	-.052	.392
SCAT Scores	-.321	.091	—	.427	.200
Total Grade Point Average	.170	-.052	.427	—	.301
Physical Education Grade	.508	.392	.200	.301	—

Motor Educability

The coefficient of correlation between motor educability and SCAT scores for the total group of subjects was .091 indicating no significant relationship. Therefore, it can be concluded, on the basis of this study, that physical aptitude and mental aptitude cannot be predicted from each other.

The coefficient of correlation between motor educability and total grade point average for one semester was -.052 which was not

significant. Thus, one would not be justified in attempting to predict academic success from a test of physical educability.

The coefficient of correlation between motor educability and grades achieved in physical education classes was found to be .392. A t test revealed this relationship to be significant at the .05 level of confidence. As has been discussed previously, a test of motor educability appears to have considerable merit for predicting success in physical education activities.

School and College Ability Scores (SCAT)

As shown in Table VII, page 44, the coefficient of correlation of SCAT scores with total grade point average was .427. This relationship yielded a t of 3.62 and was significant at the .01 level of confidence. This relationship confirms the ability of the SCAT test to predict academic success.

The coefficient of correlation between SCAT scores and grades achieved in physical education activity classes was .200. The t of 1.12 was not significant indicating that apparently this mental test is unable to predict success in physical endeavors. It should be pointed out, however, that the activity grades in this study were based solely on physical skills, whereas in most programs physical education grades include written knowledge tests. Perhaps the SCAT test would have more predictive power in such cases.

As stated before, the relationship between SCAT scores and motor educability was .091, indicating an extremely low and insignificant relationship.

Total Grade Point Average for One Semester

The coefficient of correlation between total grade point average and physical education grades was .301. This coefficient does indicate some degree of relationship between the variables studied and a t of 2.11 was found to be significant at the .05 level of confidence.

As stated earlier, and as shown in Table VII, page 44, the coefficient of correlation between total grade point average for one semester and SCAT scores was .427 and was significant at the .01 level of confidence.

The relationship between total grade point average and motor educability was a negative one, showing a correlation coefficient of -.052.

Grades Achieved in Physical Education Activity Classes

These data have been presented in earlier sections, but in order to present them collectively, they appear again in this section. These data may also be viewed in Table VII, page 44.

The coefficient of correlation between physical education grades and motor educability was .392. This relationship was significant at the .05 level of confidence. The coefficient of correlation between physical education grades and SCAT scores was .200 which was not significant. The coefficient of correlation between physical education grades and total grade point average for one semester was .301 and was significant at the .05 level of confidence.

CHAPTER V

SUMMARY, FINDINGS, AND CONCLUSIONS

I. SUMMARY

It was the purpose of this study to determine the relationship of physical fitness to motor educability, scholastic aptitude, total grade point average for one semester and an activity grade in a basic skills course in physical education.

The subjects for this study were 113 college freshmen students enrolled in tennis, golf and swimming in the basic skills program at Pensacola Junior College, Pensacola, Florida.

The Navy Standard Physical Fitness Test was administered to these students in order to determine a level of physical fitness. This test includes push-ups, pull-ups, squat jumps, sit-ups and squat thrusts for one minute.

The Adams Motor Educability Test (sports-type) was used as a measure of motor educability. This test includes a volleyball wall volley, tennis ball toss, volleyball ball bounce on bat, and basketball free-throw shooting.

The School and College Ability Test was utilized as a measure of scholastic aptitude. This test includes both quantitative and verbal batteries and the score used for this study was the total score for both batteries.

The total grade point average was computed by dividing the total number of hours carried into the total number of quality points. This information was made available to the writer by the Registrar at Pensacola Junior College. These data were for the fall semester of the 1963-64 school year.

In determining activity grades in tennis, golf and swimming, a uniform procedure of grading was agreed on by all instructors concerned. The grade was to be based entirely on physical skill achievement, and the grade submitted was numerical rather than a letter grade.

Statistical computations were calculated in the laboratory of the Louisiana State University Computer Center. The data were analyzed to determine relationships between physical fitness and each of the other variables for the total group of subjects. Coefficients of correlation were also computed between physical fitness and motor educability for each of the activity groups. Intercorrelations between all the variables were calculated and, in addition, comparisons of means were done between those subjects scoring high and those scoring low on the physical fitness test for each of the variables in the study.

II. FINDINGS

The findings of the investigation were:

1. Significant correlation was found between physical fitness and motor educability.

2. Physical fitness was significantly related to physical education activity grades.
3. A significant correlation was found when activity grades in physical education classes were regressed on physical fitness and motor educability.
4. There was no significant relationship between physical fitness and the School and College Ability Test (SCAT), nor with physical fitness and total grade point average.
5. The following results were found when intercorrelations were computed between the variables of motor educability, SCAT scores, total grade point average and physical education activity grades:
   a. Motor educability was significantly related to physical education activity grades.
   b. There was a significant correlation between SCAT scores and grade point averages for one semester.
   c. Total grade point average was found to have a relatively low but significant correlation with physical education activity grades.
6. Physical fitness and motor educability did not correlate with grades achieved in golf as highly as they did with tennis and swimming.

III. CONCLUSIONS

1. The degree of physical fitness that a person possesses does

not correlate with his performance on a test of scholastic aptitude, nor was it found that physical fitness is directly related to scholastic achievement as measured by the student's grade point average for one semester.

2. Physical fitness is related to performance on a test of motor educability of the sports-type.
3. Physical fitness and motor educability both are important in predicting achievement in physical education activity classes.
4. A scholastic aptitude test successfully predicts academic achievement as measured by total grade point average, but is not effective in predicting success in physical activities.
5. Mental aptitude, as measured by the School and College Ability Test is not related to physical aptitude as measured by a motor educability test of the sports-type, therefore, neither should be used as a single prognostic device to assess all the abilities needed for success in all college subjects.
6. Apparently, physical fitness and motor educability are not as important for success in golf, as measured by activity grades, as they are for success in tennis and swimming.

IV. RECOMMENDATIONS FOR FURTHER STUDY

Based on the findings of this investigation, the author

recommends the following suggestions for further study:

1. An investigation utilizing a more extreme range in levels of physical fitness than was available in this study may reveal relationships to other abilities that would be significant.
2. A study with a larger and more varied selection of basic skills activities would yield more information on the relative importance of physical fitness and motor educability on achievement in physical education classes.
3. A research project which covers a much longer period of time with measures of physical fitness taken periodically to determine the degree to which a person's productivity may be related to his degree of physical fitness.

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APPENDIX

APPENDIX A

DESCRIPTION OF THE NAVY STANDARD PHYSICAL FITNESS TEST[1]

Five test items for the Navy Standard Physical Fitness Test are described here.

Item 1: Squat jumps.

Equipment: None

Description: The subject assumes the squat position with his left foot slightly in front of the right. The hands are locked firmly on top of the head. At the signal to start, the subject jumps from the floor with the legs coming to a straight position on the jump. On the descent, the subject switches the position of the feet so that the opposite foot of the prior squat is in front. This exercise is continued until the subject is fatigued. The subject is instructed to switch the feet only slightly in order to maintain balance and to assume a full squat after the jump.

Rules:

1. The subject cannot rest at any time after the beginning of the exercise.
2. If the subject loses his balance, he is instructed to continue the exercise as quickly as he can upon regaining balance.

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[1]Leonard A. Larson and Rachael D. Yocom, Measurement and Evaluation in Physical, Health and Recreation Education. (St. Louis, Mo.: The C. V. Mosby Co., 1951), p. 177.

3. No score is recorded for a jump or squat that is not executed in the proper manner.

Scoring: One point is recorded for each complete squat jump. The total score is the total squat jumps completed by the subject.

Item 2: Squat Thrusts

Equipment: None

Description: The subject stands erect with his hands at his side and at the signal to start, he places his hands on the floor (inside his knees and eight inches in front of feet) and thrusts his feet, legs and body backward until he is fully extended. He then brings his feet back to the original position with his hands still on the floor and again assumes an upright, erect position.

Rules:

1. The subject must stand upright at the beginning and each time he arrives at the standing position during the course of the exercise.
2. The subject must fully extend his body in the thrust.
3. The subject must place his hands inside his knees as he goes into the squat position.
4. The subject should not touch his body to the floor during the thrust or in returning to the squat position after the thrust.

Scoring:

1. The total score is the number of completed squat thrusts that the subject can do in one minute.

2. Any violation of rules during the squat, thrust, return to squat, or the upright position results in loss of the complete sequence.
3. Subjects are given an additional point if they have completed at least through the thrust position at the end of the one minute period. If the subject has not completed the thrust, the last completed sequence is the total score.

Item 3: Push-ups

Equipment: None

Description: The subject assumes the push-up position with head erect and back straight and arms fully extended. At the signal to begin, he lowers himself until his chest touches the recorder's hand which is lying flat on the floor.

Rules:

1. The subject must go down until his chest touches the recorder's hand.
2. The subject must come up to a proper starting position on each push-up.
3. The subject must not rest in either the down or the starting position.
4. The subject must keep his head erect at all times.
5. Subject must exercise until he is fatigued.

Scoring:

1. Any violation of rules results in loss of the entire point

for the push-up.

2. Total score is total number of completed push-ups.

Item 4: Sit-ups

Equipment: One large wrestling mat.

Description: The subject lies flat on his back with the soles of his feet against the knees of the recorder. The recorder holds the subject at the ankle to assure stability. The subject interlocks his fingers at the back of his head. At the signal to start, he sits forward and brings his right elbow across to touch the left knee and back down. He then sits forward again and touches the left elbow to the right knee and continues to alternate this sequence each time he assumes the sitting position.

Rules:

1. The subject must maintain a constant rhythm once the signal to start has been given.
2. The subject must keep his hands locked behind his head throughout the exercise.
3. The subject must touch the appropriate elbow to the appropriate knee and alternate in proper sequence as instructed.
4. The subject must touch both shoulder blades to the mat as he returns to the lying position.
5. The subject must keep his knees straight.

Scoring:

1. The total score is the total number of sit-ups the subject

can do until fatigued.

2. Any violation of the above rules results in loss of one point for that sit-up.

Item 5: Pull-ups

Equipment: Chinning bar

Description: The subject jumps to the bar, using the pronated grip (palms forward) and pulls himself up so that his chin clears the bar. He then descends into the starting position and establishes a reasonably fast cadence. He essentially retains this cadence throughout the exercise.

Rules:

1. The subject's chin has to clear the bar.
2. The subject has to descend to the starting position with the arms fully extended.

Scoring:

1. The total score is the total number of pull-ups the subject can do correctly.
2. Any violation of the above rules results in loss of one point for that pull-up.

APPENDIX B

DESCRIPTION OF THE ADAMS MOTOR EDUCABILITY TEST (SPORTS-TYPE)[1]

Adams conducted a study in which he selected a battery of tests from an experimental group of forty-nine tests that would maximally predict sport-type motor educability for male college freshmen. He used the Wherry-Doolittle Test selection method to select the smallest number of tests which would maximally predict the criterion.

He selected the four tests which had the highest validity of any combination of tests in the experimental battery. The multiple correlation between the criterion and these four items was .789. The test items are:

Item 1: Wall-volley

Facilities and Equipment: (1) a flat surfaced wall, not less than twenty feet high and thirty feet long and (2) a regulation volleyball inflated to three pounds of air pressure.

Description: The subject stands three feet from a wall and volleys a volleyball above a line drawn on the wall ten and one-half feet above the floor. He attempts to volley the ball against the wall up to ten times consecutively. The subject has seven separate

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[1]Arthur R. Adams, "A Test Construction Study of Sport-Type Motor Educability for College Men" (unpublished Doctoral dissertation, Louisiana State University, Baton Rouge, Louisiana, 1954).

trials and on each trial he attempts to volley the ball ten times in succession against the wall.

Rules:

1. The subject must not cross the three foot line at any time during the volleys against the wall.
2. The subject must volley the ball according to volleyball rules. He must not hold nor catch the ball.
3. He must volley the ball above the ten and one-half foot line drawn on the wall.
4. No practice is allowed after demonstration by the scorer.

Scoring:

1. The score on each trial is the number of consecutive volleys up to ten.
2. The total score is the sum of the scores made on seven trials.

Item 2: Tennis Ball Toss

Equipment: One regulation size tennis ball

Description: The subject lies flat on his back holding a tennis ball. He tosses the ball six feet or higher into the air and catches it in either hand, but not both hands, while remaining in the "lying on back" position.

Rules:

1. The subject must not catch the ball in both hands.
2. The subject must toss the ball at least six feet in the air.

3. The subject must retain the "lying on back" position when tossing and catching the ball.

4. No practice is permitted by the subject.

Scoring:

1. The total score is the number of successful attempts in ten trials.

2. Any violation of the rules results in an unsuccessful toss.

Item 3: Ball Bounce on Bat

Facilities and Equipment: (1) one regulation size volleyball, inflated to three pounds of air pressure; (2) one medium weight 36-inch softball bat; and (3) one circle, six feet in circumference.

Description: The subject stands inside a six foot circle and attempts to bounce a volleyball on the top, or large, end of a softball bat which he hold in an upright position with one hand placed about one hand's width below the thick end of the bat. With each attempt at this bounce, the subject endeavors to bounce the ball ten times consecutively on the end of the bat.

Rules:

1. The subject must not step out of the circle while bouncing the volleyball on the softball bat.

2. The subject must not bounce the ball on any part of the bat except the end or the thick portion of the bat.

3. No practice is permitted by the subject.

Scoring:

1. The number of consecutive bounces, up to ten, is recorded

on each of ten trials.

2. The total score is the sum of the scores made on the ten trials.

Item 4: Free-throw Shooting

Facilities and Equipment: (1) one regulation size basketball, inflated to eight pounds of air pressure; and (2) one regulation size basketball goal with proper netting.

Description: The subject takes twenty shots from the free-throw line, using any method he wishes for these shots.

Rules:

1. The subject must not step over the free-throw line while attempting to make the shots.
2. No practice by the subject is permitted.

Scoring:

1. The score is the number of successful shots in twenty trials.
2. If the subject steps over the free-throw line on any shot, it is scored as a miss by the scorer.

APPENDIX C

DESCRIPTION OF THE SCHOOL AND COLLEGE ABILITY TEST[1]

In discussing the School and College Ability Test, Cronbach said:

> This test is offered to replace the ACE test, as a device primarily for predicting academic success. A verbal score measures vocabulary and reading comprehension; a quantitative score measures arithmetic, reasoning and arithmetic operations. Both measure school-learned abilities. This test should serve well for selecting potential college-goers and appears highly suited for use by educators not necessarily psychologically trained.
>
> In considering the general purposes for which the SCAT series was to be designed and the continuity of measurement that was to be a principle objective in development of the series, the advisory committee recommended strongly that the new tests should measure school-learned traits which afford measurement of capacity for school learning. This recommendation was based on three general observations shared by all members of the committee:
>
> a. That the best single predictor of how well a student is likely to succeed in his school work next year, is "how well he is succeeding this year;"
>
> b. That a certain few school-learned abilities appear to be critical prerequisites to next steps in learning throughout the range of general education--among them skills in reading and in handling quantitative information; and
>
> c. That school-learned abilities usually can be discussed with students and parents in a more objective way than can such emotionally-loaded characteristics as "intelligence and mental ability."[2]

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[1] School and College Ability Test, Cooperative Test Division, Educational Testing Service, 20 Nassau St., Princeton, New Jersey, and 4640 Hollywood Blvd., Los Angeles, California.

[2] Lee J. Cronbach, Essentials of Psychological Testing, (second edition; New York: Harper and Brothers, 1960), pp. 236-37.

APPENDIX D

DESCRIPTION OF THE AMERICAN NATIONAL RED CROSS SKILLS TEST FOR BEGINNING SWIMMERS[1]

Test items for the American National Red Cross Swimming Skills Test for beginning swimmers are as follows:

1. Breath holding. Face fully submerged, breath to be held ten seconds at least.

2. Rhythmic breathing. The pupil, standing in chest-deep water, must alternately inhale through the mouth above the surface and exhale through the mouth and nose with head completely submerged ten times rhythmically and continuously.

3. Prone float. In waist-deep water, the pupil must take a prone position on the water and recover to standing position without assistance or support.

4. Prone glide. This is done successfully when the learner pushes off face down in waist-deep water, takes a prone position, glides a distance of at least two body lengths, and recovers to standing position.

5. Back float. The pupil must assume a back floating position in waist-deep water, hold the position with the face above water for at least ten seconds, and return to standing position unaided. Note:

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[1]American National Red Cross, Instructor's Manual--Swimming and Diving Courses, ARC 1042, Washington, D.C. Pp. 33-34.

If the heels rest on the bottom, or the pupil uses gentle paddling movements of the feet to maintain a somewhat horizontal position, he may be checked off as having passed the test.

6. Back glide. From a position in waist-deep water, with arms at sides, the pupil sits back, pushes off, glides a distance of at least one body length, and resumes his standing position in a confident and easy manner.

7. Kick glide on the front. In waist-deep water, the pupil should demonstrate his ability to push off in prone gliding position, pick up the beginner's leg stroke in a smooth and unhurried manner, and kick his way along from three to five body lengths before resuming standing position.

8. Kick glide on the back. In waist-deep water, the pupil demonstrates his ability to take a back gliding position, use the beginner's leg stroke on the back for a distance of three to five body lengths, and recover to standing position with ease.

9. Arm stroke (human stroke or dog paddle). In waist-deep water, pupil assumes prone position with face submerged and, with legs trailing or kicking gently, does the arm stroke in series, demonstrating that he can effectively pull and recover the arms and make progress thereby.

10. Arm stroke on back. In waist-deep water, pupil starts back glide, then "fins" his way along far enough to demonstrate that the stroke is actually propelling him.

11. Combined strokes on the front. In water of standing depth,

the pupil demonstrates his ability to swim a coordinated beginner's stroke continuously for a distance of twenty to twenty-five yards along shore, if out-of-doors; four to six widths of the pool, if indoors. Recovery of arms over the surface in a modified crawl is allowable in this test.

12. Combined strokes on the back. In water of standing depth, the pupil swims a minimum distance of ten yards comfortably and somewhat easily, using finning and the beginner's flutter kick in combination.

13. Change of direction. In water of standing depth, the pupil starts swimming the beginner's stroke on the front and in stroke makes an abrupt right angle turn toward the beach or shallow water. He then repeats the test, making his turn to the left. Finally, he demonstrates his ability to make a complete turnabout to return along his course. (Note: Under careful supervision, additional trials on the complete turnabout may be made by swimming a few strokes from standing depth into deep water and then returning to the starting position).

14. Turning over. To test the pupil's ability to change from one swimming or floating position to another, he will start swimming on the front in water chest-deep, parallel to the shore or shallow end of the pool. From the front swimming position, he rolls onto the back and remains there floating motionless or resting in a floating position and then continues swimming.

15. Leveling off. Under supervision the pupil wades to position

in neck-deep water, then turns and faces the shore. With a minimum of push-off from the bottom, he swims his way to the horizontal and continues to waist-deep water before he stands. As an added step, after he has learned to jump into shallow water, fall forward, and swim, he may, under supervision, take a position on the dock or deck of the pool a few feet beyond water of standing depth and jump in on an angle, come up, level off, and swim to a point where he can stand.

16. Feet foremost jump into waist-deep water. This test can be given early in the course as it is very easy to accomplish. It should finish with a glide, or kick glide, or the combined beginner's stroke on the front.

17. Jump into deep water, level, and swim. If this has not been done already as a part of No. 15 as suggested, it should now be given. This test should be given toward the end of the course.

18. Plain front header. This test is given to the pupil after he has mastered the steps in learning how to do a front dive. It should be done from a solid deck at a low elevation, over water neck-deep, and he should finish by emerging and swimming a little way along the surface.

19. The pupil jumps into deep water, levels off, and swims fifteen yards. Without stopping or touching, he turns about and swims back to the starting point.

20. The pupil does a plain front header, from deck or dock, levels off, and swims fifteen yards, turns about, and starts swimming back.

Halfway back, he turns on the back and rests either motionless or with gentle paddling movements for fifteen seconds. He turns back again to front swimming position and swims to starting point.

VITA

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Title of Thesis: A Study to Determine Relationships of Physical Fitness to Motor Educability, Scholastic Aptitude, and Scholastic Achievement of College Men

Approved:

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